SHORT PAPER

Effects of Environment upon Tortoise Pigmentation

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ABSTRACT

An experiment lasting for six months, on two initially homogeneous sibling groups of young Krefft's tortoises, *Emydura krefftii*, showed that pigmentation in these tortoises was influenced by the colour of the substrate upon which they lived.

INTRODUCTION

Numbers of native and exotic tortoises are regularly bred at the Royal Melbourne Zoological Gardens. Hatchlings of aquatic species are usually housed in open-topped plastic containers for approximately the first year of life.

It has been observed that tortoises kept in containers of a light colour become consistently paler than typically coloured individuals of their species. Such pallor has been noted in Zoo-bred *Emydura krefftii, E. macquarii, Chelodina longicollis, C. expansa* and the terrestrial American box tortoise, *Terrapene carolina.* When some of these animals were transferred to darker coloured surroundings they soon resumed a normal hue.

Published descriptions of tortoise colouration by various authors suggest that although individual variation occurs, the colour of a particular tortoise does not change, and I have yet to read an account of colour change in tortoises. This suggestion has usually resulted in expressions of surprise or scepticism. To resolve the matter, I carried out a simple experiment on *E. krefftii* over a six-month period. Typical carapace colouration of *E. krefftii* is described as "dark brown" (Worrell, 1964), and "brown to dark brown above" (Cogger, 1975).

MATERIALS AND METHODS

Two-glass fish tanks, each measuring 30 x 20 x 20 cm were used for the experiment. To provide contrasting floor colours, a sheet of white paper was placed beneath the transparent base of one tank, and a piece of rigid black plastic was cut and fitted inside the other.

The tanks were partly filled with tap water which was maintained for the duration of the experiment at 25-27°C.

On 19/11/79 four individuals of *E. krefftii,* similar in colour and size, were selected from a clutch of eighteen hatched five weeks earlier, and these were housed two to a tank. At this stage the young tortoises were of a medium grey-brown colour and very conspicuous against the black and white floors of their respective tanks.

Within the tanks, conditions, with the exception of the floor colours, were kept as alike as possible. Water depths and temperatures were identical, as was the food given to the tortoises (finely chopped raw meat and fish, live daphnia, mosquito larvae and house-fly pupae). A small block of plaster-of-Paris was immersed in each tank to ensure dissolved calcium levels adequate for healthy shell growth. A flowlux aquarium light, suspended 30 cm above the tortoises, was switched on at 8.15 a.m. for approximately 7½ hours daily.

RESULTS

Within seven days of commencing the experiment a colour difference between the two groups was apparent. The tortoises in the black-based tank (Group A) were uniform grey-brown, while those of Group B were paler, with a few dark spots on the dorsal surface and a line of darker pigment around the periphery of each carapace scute, forming a reticulate pattern.

One month later the difference was distinct. Group A animals had become considerably darker and those of Group B were more pallid. In both groups the skin of the head, neck and limbs, as well as shell scutes, was affected. Six months from commencement of the experiment, the contrast between the two groups was quite dramatic. Group A animals had become a dark slate grey colour while those of Group B had faded to a light fawn.

At this stage the two groups were photographed, (Fig. 1), and the four tortoises returned to the company of their siblings in a large, neutral coloured tank. Within one month the pallid tortoises had reverted to the grey-brown colour of their companions, while the dark individuals required approximately twice this period of time before they too became virtually indistinguishable from their siblings.

DISCUSSION

The hard exoskeleton of adult Australian tortoises provides effective protection against most predators, but juveniles of all species appear to be vulnerable to attack from predatory birds, reptiles (Goode, 1967) and eels and other fish (Cann, 1978), and their survival depends largely upon their ability to avoid detection.

In Australia, tortoises are found in a wide range of aquatic habitats including rivers, water-holes, swamps and billabongs. The substrates of various water-bodies may differ greatly, ranging from black mud to white sand. The ability to

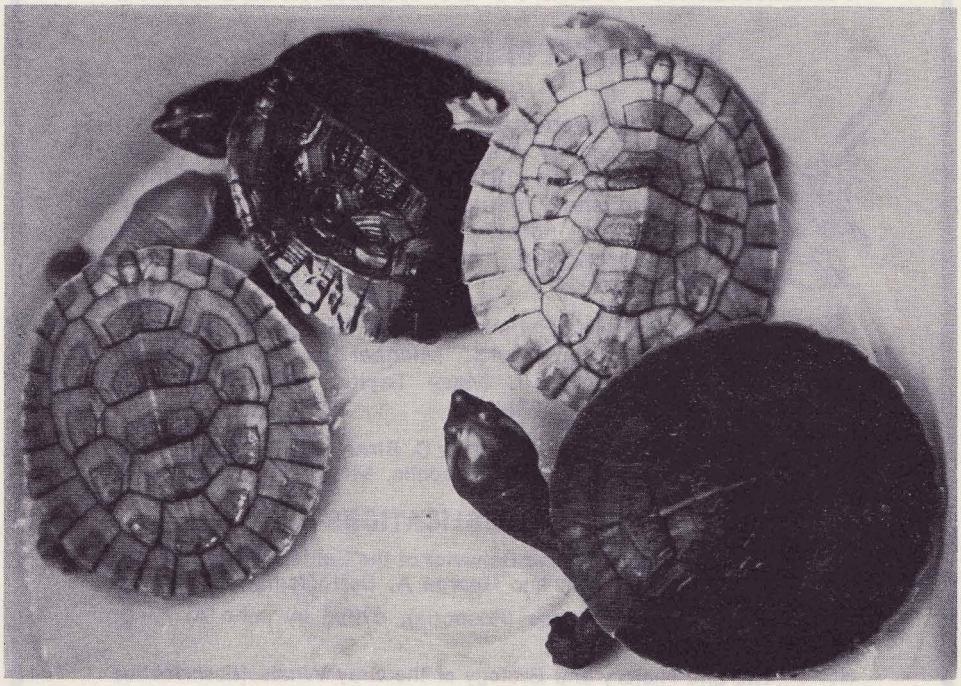

Fig. 1. Young *Emydura krefftii* reared for six months in a white-floored container (Nos. 1 and 3 from left) and a black-floored container (Nos. 2 and 4).

assume cryptic colouration consistent with a particular substrate has obvious advantages for tortoises, increasing an individual's chances of avoiding predation and allowing effective exploitation of a wider range of habitats by the species.

In view of its survival value it is therefore not surprising to find that the pigmentation of juvenile tortoises, at least of some species, is capable of modification.

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